CLINICAL PREDICTORS OF PNEUMONIA AMONG CHILDREN UPTO 12 YEARS OF AGE WITH WHEEZING

Dissertation submitted to

THE TAMILNADU DR.M.G.R. MEDICAL UNIVERSITY

In partial fulfillment of the regulations

for the award of degree of

M.D. DEGREE (PAEDIATRICS) BRANCH VII

INSTITUTE OF CHILD HEALTH AND

HOSPITAL FOR CHILDREN

MADRAS MEDICAL COLLEGE

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CERTIFICATE

This is to certify that the dissertation titled, **"Clinical predictors of pneumonia among children upto 12 years of age with wheezing"** submitted by **Dr.M.Sarasu**, to the Faculty of Paediatrics, The Tamilnadu Dr.M.G.R medical university, Chennai, in partial fulfillment of the requirements for the award of M.D.Degree (Paediatrics) is a bonafide research work carried out by her under our direct supervision and guidance, during the academic year 2010-2012.

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DECLARATION

I**, Dr.M.Sarasu,** solemnly declare that the dissertation titled "Clinical Predictors of Pneumonia among children upto 12 years of age with wheezing" has been prepared by me.

This is submitted to the Tamilnadu Dr. M.G.R. Medical University, Chennai in partial fulfillment of the rules and regulations for the M.D.Degree Examination in Paediatrics.

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CONTENTS

INTRODUCTION

INTRODUCTION

Asthma, bronchiolitis and pneumonia are commonly seen causes of respiratory distress in children. Among children with wheeze co-existing pneumonia is the leading cause of morbidity and mortality. Hence it is vital to diagnose and treat pneumonia early.

The estimated incidence of pneumonia in children less than 5 years of age, in developing countries, in the year 2000 was 0.28 episodes per child-year (1) whereas in developed countries, it is 0.05 episodes per child-year. (2)

Community acquired pneumonia has its greatest impact in the developing countries. Pneumonia is the leading cause of death among children under five years of age (24% of all deaths under 5 years of age) (3) in India. About 1.2 million annual deaths are reported worldwide among children less than 5 years of age with pneumonia which is more than malaria, tuberculosis and AIDS combined[WHO] (4). Lower respiratory tract infections account for 11.3% of all deaths in the low income countries (5). Pneumonia can be defined as inflammation of lung tissue often initiated by an infectious agent resulting in lung damage.

Recovery from pneumonia may be complete or partial.

Pneumonia can be caused by viruses, bacteria, fungi or parasites.

Most important factors for developing bacterial pneumonia are virulence of the pathogen, absence of specific immunity and presence of preceding viral respiratory infection.

RISK FACTORS FOR PNEUMONIA:

1. Young age
2. Prematurity
3. Preexisting lung disease
4. Environmental exposure like passive smoking
5. Overcrowding
6. Low socio economic status
7. Exposure to infected children
8. Nosocomial
9. Immunosupression
10. Malignancy

PATHOGENESIS:(15)

The lung is protected from bacterial infection by the following mechanisms:

1. Filtration of particles in the nostrils
2. Prevention of aspiration by epiglottal reflex
3. Expulsion of infectious material by cough reflex
4. Expulsion of organism by mucous secreting cells
5. Killing of bacteria by macrophages
6. Neutralization of bacteria by local or specific immunity
7. Transport of particles by lung lymphatic drainage

Alteration in the above barriers results in pneumonia.

ETIOLOGY (2)

Common etiological agents in different age groups are:

Newborns

Group B streptococcus

Gram negative bacteria

1 to 3 months

Viruses

Bordetella pertussis

Chlamydis trachomatis

Ureaplasma urealyticum

1 to 12 months

Viruses

Pneumococcus

Staphylococcus.aureus

Hemophilus .influenza

Moraxella catarrhalis

1 t0 5 years

Pneumococcus

Viruses

Chlamydiae.pneumoniae

Mycoplasma.pneumoniae

Older than 5 years

Mycoplasma.Pneumoniae

Streptococcus .Pneumoniae

Chlamydiae.Pneumoniae

CLINICAL FEATURES OF PNEUMONIA

Symptoms and signs of pneumonia vary with age of the patient, bacteria causing, and the severity of the disease. Some organisms causes specific patterns of disease like lobar consolidation of pneumococcus and empyema , pneumatocele and abscess caused by Staphylococcus aureus. But any pathogen can cause any of these manifestations. (15)

General signs of pneumonia are tachypnea, dyspnea, cough, grunting, and nasal flaring. Child may lie on the affected side due to chest pain. Abdominal pain can be there due to gastric dilation due to swallowed air or ileus.

Respiratory system findings in pneumonia are decreased tactile and vocal fremitus on palpation, dullness to percussion, and decreased breath sounds and rales over involved areas on auscultation. Irritation of pleura causes chest pain.

Extrapulmonary infections like skin abscesses, sinusitis, otitis media, and meningitis can occur along with bacterial pneumonia. Hemophilus influenza pneumonia can be accompanied by epiglottitis or pericarditis.

DIAGNOSIS:

It is difficult to identify the etiological agent in bacterial pneumonia Sputum is difficult to obtain from smaller children as they swallow it. Adequate sputum specimen should have at least 10 polymorphs and less than 25 epithelial cells per low power field.(2)

Nasopharyngeal cultures are misleading because of higher rate of bacterial carriage.

Gold standard for finding out the etiological agent is Broncho Alveolar Lavage or obtaining lung puncture specimen. But both are invasive and cannot be used routinely for all cases. (2)

PCR is useful in the diagnosis of viral, chlamydial and mycoplasma pneumonia but does not distinguish carrier state from invasive infection. Detection of antigen in plasma and urine has very low sensitivity and specificity. Serological tests require paired samples for confirmation which often can be used only for retrospective diagnosis. In children < 6months of age with low immune response, serology is not useful.(2)

WBC count, CRP and ESR which are often raised in bacterial pneumonia cannot be reliable to distinguish viral from bacterial pneumonia. Viral pneumonia is usually associated with bilateral interstitial infiltrates. Even x-rays which are commonly used cannot reliably distinguish viral from bacterial pneumonia. (2)

MANAGEMENT OF PNEUMONIA:

GENERAL MANAGEMENT:

In children with severe respiratory distress, supplementary oxygen should be provided to keep the oxygen saturation above 92%.Adequate hydration should be maintained by using IV fluids if necessary. Antipyretics should be used to bring down fever.

USE OF ANTIBIOTICS:

Antibiotics are used in suspected bacterial pneumonia. Viral and bacterial pneumonia are often difficult to distinguish clinically as well as radiologically. It is also difficult to isolate the etiological agent by most of the tests described. So antibiotics are often started empirically. The choice of empirical antibiotics is based on the clinical features, prevalence of various organisms in different age groups, and regional variation in the pathogens

Table: 1

Etiological organism	First choice	Other
Pneumococcus	Penicillin, high-dose amoxicillin or ampicillin	Ceftriaxone, azithromycin, Cefuroxime.
Penicillin resistant S.pneumoniae	Second- or third-generation cephalosporins for sensitive strains; vancomycin	-
Staphylococcus aureus	Methicillin/oxacillin	Vancomycin , teicoplanin
Haemophilus influenzae	Amoxicillin	cefuroxime, ceftriaxone, other second-and third-generation cephalosporins, Amoxicillin/clavulanate,
Moraxella catarrhalis	Amoxicillin/clavulanate	Cefuroxime

Table: 1- Ref no (2)

Table:2

CHOICE OF ANTIBIOTIC USAGE IN DIFFERENT AGE GROUPS

Age/clinical picture	Inpatient	Outpatient
Newborn	Ampicillin or penicillin G + gentamicin	—
3 weeks to 3 months, with interstitial infiltrate, not sick looking	Macrolides	Macrolides
4 months to 4 years	Penicillin or ampicillin; if not responding add macrolide.	Amoxicillin
Above 5 years with Alveolar infiltrate/ pleural effusion/ toxic appearance	Penicillin or ampicillin; if not responding add macrolide	—
Necrotizing pneumonia	Oxacillin / nafcillin; Vancomycin [MRSA]. Consider adding third-generation cephalosporin	

Table: 2(2)

Table: 3(2)

Antibiotic Dosages for the Treatment of Pneumonia
Penicillin 100,000 U/kg/day, q4h or q6h (up to 400,000 U/kg/day for resistant strains) for 7-10 days
Ampicillin100-200 mg/kg/day q6h for 7-10 days (IV), 50 mg/kg/day, q6h, for 7-10 days (PO)
Amoxicillin 50 mg/kg/day, q8h or q12h, for 7-10 days (for resistant strains dose can be increased up to 100 mg/kg/day)
Amoxicillin/clavulanate 40 mg/kg/day of amoxicillin for 7-10 days
Cefuroxime Oral 30 mg/kg/day, q12h, for 5-7 days ,150 mg/kg/day, q8h, iv for 7-10 days
Oxacillin/nafcillin 150 mg/kg/day, q6h, maximum 12 g/day, for 14-21 days
Cefotaxime 200 mg/kg/day, q8h, for 7-10 days
Ceftriaxone 50-75 mg/kg/day, qd, for 7-10 days
Cefdinir 14 mg/kg/day, q12h, for 7-10 days
Cefprozil 15-30 mg/kg/day, q12h, maximum 1 g/day, for 7-10 days
Cefpodoxime proxetil 10 mg/kg/day, q12h, maximum 400 mg/day, for 7-10 days

Erythromycin 40 mg/kg/day, q6h, for 5-7 days
Clarithromycin 15 mg/kg/day, q12h, maximum 1 g/day, for 5-7 days
Azithromycin Oral 10 mg/kg/day, qd, for 3-5 days
Vancomycin 40-60 mg/kg/day, q6h, for 7-10 days (14-21 days for *S. aureus*)
Gentamicin 7.5 mg/kg/day, q8h, for 7-10 days

Duration of therapy depends on the organism causing pneumonia. For group B streptococcus and gram negative bacilli a course of 7 to 10 days is recommended. For staphylococcal pneumonia, 3 -6 weeks of antibiotic therapy is recommended. However the etiological agent is often not identified in most of the patients. (15)

Patients are classified into pneumonia, severe pneumonia, very severe disease based on WHO criteria. For patients with non-severe pneumonia, Oral amoxicillin or co-trimoxazole for 3-5 days is recommended. (6)

All patients with severe pneumonia should be hospitalized and started on IV ampicillin 50 mg/kg 6^{th} hourly(6). If there is no response in 48 hours, gentamicin is added. Infants less than 2 months of age with severe pneumonia should be started on ampicillin along with gentamycin.

For children with very severe pneumonia ampicillin with gentamycin is started from day 1 onwards. If there is no response in 48 hours, third generation cephalosporin is added. In case of suspected septicemia or meningitis third generation cephalosporin should be started intravenously. Antibiotics are given for 7 to 10 days for severe pneumonia and 10-14 days for very severe pneumonia. (6)

Failure of response may be due to inappropriate drug selection, resistant organism, inadequate dosage, poor compliance or inadequate host defenses.

Apart from pneumonia, other causes of wheezing in children are hyper reactive airway disease, bronchiolitis, airway anomalies like laryngo/ tracheo / bronchomalacia, vascular rings, retained foreign body, GERD etc.

Pneumonia is the major cause of morbidity and mortality in children with wheeze. In children with wheezing, frequent episodes are common during early childhood. Each time treating physician is faced with dilemma whether to start on antibiotics.

Culture of Broncho alveolar lavage fluid and lung puncture specimen which are considered as Gold standard for the diagnosis of bacterial pneumonia are invasive, not available in all health care settings and hence cannot be used routinely in all patients. So x-rays are ordered often in wheezing children, to diagnose pneumonia. Antibiotics are

started if focal infiltrates or consolidation, or consolidation with effusion is present in x-ray. This practice exposes the child to unnecessary radiation. If the clinical predictors, which can be used to predict pneumonia with good sensitivity and specificity, are known, X-rays can be avoided thus saving health care costs. It can also guide clinicians to decide on antibiotic therapy.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

E.Melinda Mahabee-Gittens, et al did a retrospective study in wheezing children ≤18months of age, who had visited the emergency department of Children's hospital medical center, Cincinnati, Ohio. Children ≤ 18 months of age with wheeze on clinical examination were included. Those children with conditions predisposing to pneumonia like cystic fibrosis, broncho pulmonary dysplasis, congenital heart disease sickle cell anemia, recent foreign body aspiration were excluded.(7)

Detailed history and clinical examination was done in all study subjects. Data collected include age, sex, duration of symptoms, history of fever, highest recorded temperature, initial temperature, lowest recorded oxygen saturation , presence or absence of grunt, localized wheezing, crackles, decreased breath sounds, and retractions.(7)

They compared the characteristics of patients with and without focal infiltrates on chest x-ray. They found that patients with focal infiltrates were more likely to have a temperature of ≥38.4 degree Celsius, crackles on examination and history of fever.

Duration of symptoms, retractions, respiratory rate≥60, first time wheezing, oxygen saturation ≤ 93%, and wheezing were not associated with radiographic pneumonia. They concluded that chest x-ray should be ordered only to those children with wheezing who have a history of fever, temperature ≥38.4 degree Celsius, or crackles on clinical examination.(7)

E.M.Mahabee–Gittens et al did a prospective study to determine the clinical features associated with focal infiltrates in children with wheeze. Study was conducted in the emergency department of the Children's hospital medical center, Cincinnati, Ohio for a period of six months from October 5, 1996. Study population included children upto 18 months of age with wheeze on auscultation. (8)

Historical variables and clinical examination findings assessed were duration of symptoms, fever >100.5 degree, cough, foreign body aspiration, prior history of wheezing ,passive smoking, rectal temperature, respiratory rate, oxygen saturation, nasal flare ,grunt, decreased breath sounds, stridor, or crackles.(8)

Of 212 eligible patients, 23% had positive chest x-ray. They compared the patients with and without focal infiltrates on chest X-ray .They found that children with focal infiltrates were more likely to have grunting, oxygen saturation ≤93%, crackles on clinical examination and decreased breath sounds. They were also found to be 3 times (95% CI 1.4, 6.0) more likely to require hospital admission. (8)

By multivariate analysis, patients with oxygen saturation ≤ 93% and grunting on examination were 2.2 times (95%CI 1.1, 4.8) and 4.1 times (95%CI 2.0, 8.6) respectively, more likely to have radiological infiltrates. The specificity and sensitivity of those two combined variables were 97% and 12.5% respectively.(8)

They concluded that grunting and oxygen saturation ≤ 93% when combined was highly specific in predicting radiological pneumonia in wheezing children up to 18 months of age. But due to low sensitivity of those combined variables in predicting pneumonia, their absence does not help in ruling out focal infiltrates. (8)

Bony Mathews did a prospective cohort study in children ≤ 21 years of age who were attending the emergency department of Children's Hospital Boston. The study was done for one year period from November 2006. Children ≤ 21 years with wheeze on examination and for whom chest x-ray was ordered were included in the study. 247 patients met the inclusion criteria. 26 patients (4.9% [95%CI 3.3-7.3]) had radiographic pneumonia.(9)

Variables assessed were presence or absence of fever, cough, difficulty breathing, chest pain, abdominal pain, retractions, focal or diffuse wheeze, focal or diffuse crepitations, height and duration of fever, lack of response to bronchodilators, first episode of wheezing etc.

On comparing clinical features of patients with and without pneumonia they found out that triage temperature ≥ 38 degree Celsius (positive LR :2.03[95%CI 1.34-3.07]),history of fever at home (positive LR:1.39[95%CI 1.13-1.70]),history of abdominal pain(positive LR:2.85[95%CI 1.08-7.54]),triage oxygen saturation of <92%(positive LR:3.06[95%CI:1.15-8.16]),maximal temperature in the emergency department ≥38 degree Celsius(positive LR:1.92[95%CI 1.48-2.49]) were associated with increased risk for radiographic pneumonia. Among afebrile children (temperature <38 degree Celsius) with wheeze, rate of pneumonia was low (2.2% [95%CI: 1.0-4.7]).

They concluded that radiographic pneumonia among children with wheeze was low. Patients with fever ≥ 38.C and hypoxia had a greater likelihood of having pneumonia. Hence routine chest x-rays for diagnosing pneumonia among wheezing children must be avoided. (9)

Mark I. Neuman conducted a prospective cohort study to predict pneumonia in the emergency department in Children's Hospital Boston. Study population included children less than 21 years of age for whom chest x-ray was done suspecting pneumonia. Patients for whom chest X-ray was ordered for other reasons and who had medical conditions predisposing to pneumonia were excluded from the study. (10)

Using a questionnaire, data was collected from eligible patients. Symptoms like fever, cough, chest pain , difficulty in breathing , reason for ordering chest x-ray, retractions , grunting, wheezing, focally decreased breath sounds , rales, wheeze were entered .vital signs like temperature, oxygen saturation, respiratory rate and conditions predisposing to pneumonia were reviewed from the medical records.(10)

Sixteen percent of patients enrolled had radiographic pneumonia. History of Chest pain, duration of fever, oxygen saturation levels were significant predictors of pneumonia. Tachypnea, grunt and retractions were not associated with pneumonia. Oxygen saturation ≤ 92% was the strongest predictor of pneumonia. Rate of definite and radiographic pneumonia were 7.6% and 2.9% in subjects who did not have fever and focal findings. (10)

They concluded that by using history and clinical examination children can be stratified for the risk of radiographic pneumonia .Rate of radiographic pneumonia is high among children who have focal lung findings and hypoxia and low among children who do not have fever or focal findings on auscultation and hypoxia. Patients at low risk should be followed up and need not be subjected for x-ray.

E.Melinda Mahabee–Gittens, et al did a prospective cohort study with study population of 510 in the Cincinnati children's hospital, Ohio. Study period was 18 months from June 2000 to January 2002. Children aged 2-59 months with cough and any one of the following was included: difficulty in breathing, fast breathing, fever, chest or abdominal pain. Patients with conditions predisposing to pneumonia were excluded. (11)

Data collected include age, sex, race, number of siblings at home, smokers at home, breast or bottle feeding. Examination was done and presence or absence of irritability, nasal flaring, grunting, accessory muscle use, and decreased breath sounds, wheezing, and crepitations were noted.

Subjects with and without pneumonia were compared by chi-square test for categorical and student t-test for continuous variable. (11) Of the 510 subjects, 44% had radiographic pneumonia. Age > 12 months, tachypnea, low oxygen saturation and nasal flaring were associated with increased risk of pneumonia. They concluded that in children with symptoms of lower respiratory tract infection, age greater than 12 months, oxygen saturation 96% or less, respiratory rate 50 breaths/min or greater and nasal flaring in infancy can predict radiographic pneumonia. (11)

Tim Lynch conducted a prospective cohort study in patients aged 1-16 years who underwent chest x-ray for the diagnosis of pneumonia. They compared the presenting features of patients with and without pneumonia using the chi-square test, student‘t’ test, and calculated the odds ratio with 95% confidence interval.(12)

570 patients were studied and risk factors for focal infiltrates in chest x-ray were grunting, decreased breath sounds, crackles, fever, retractions, tachypnea, and tachycardia. (12)

They concluded that Patients with focal infiltrates were more likely to have a history of tachypnea, fever, increased heart rate, crackles, retractions, grunting, or decreased breath sounds. (12)

Oostenbrink R, Thompson M, conducted a study in children 1-16 years presenting with fever and cough to the emergency department. The study was done to develop and validate a prediction model for the early identification of pneumonia in children. It was a multicentre study done in three different patient populations. (13)

About 16%, 14%, 7% of patients were diagnosed to have pneumonia in population 1, 2, 3 respectively. They concluded that risk of pneumonia can be assessed by the respiratory rate, severity of illness and oxygen saturation. Children with low risk of pneumonia can be discharged and followed up and do not require antibiotics or x-ray. (13)

Maria-Regina A Cardoso did a prospective study in children living in St.Paulo, Brazil with the aim of finding out, to what extent, adding fever to WHO criteria, increases the ability to diagnose pneumonia. (14)

The study was conducted in children between 2 months to 59 months who were attending the emergency department of 5 hospitals in 15 months period .Children with symptoms of lower respiratory disease wheezing, crepitations, tachypnea, dyspnea were included in the study. Those with conditions predisposing to pneumonia were excluded from the study. Children were classified into two groups, with and without pneumonia, by using the WHO criteria. (14)

Sensitivity and specificity of WHO criteria and WHO criteria + fever was calculated by taking radiological pneumonia as the gold standard. By adding fever to WHO criteria sensitivity decreases from 84 to 81% and specificity increases from 19 to 46%.(14)

Then they calculated the sensitivity and specificity of both sets of criteria for children with and without wheeze. It was found that both the sets of criteria were more specific in children without wheeze.

They concluded that WHO criterion though sensitive, is less specific for identifying pneumonia, especially in children with wheezing. By adding fever to WHO criteria specificity is substantially improved, with little loss of sensitivity, thus avoiding the risk of under treatment of pneumonia. (14)

STUDY

JUSTIFICATION

STUDY JUSTIFICATION

There are many children presenting to the pediatric out patient department with respiratory distress. Majority of them have wheeze on auscultation. In children with history of wheeze or asthma, recurrent acute exacerbations are common which are often precipitated by viral or bacterial infections.

Diagnosis of pneumonia in wheezing children is difficult as the clinical history and auscultatory findings may be similar for children with or without pneumonia. As a result chest x-rays are ordered by physicians for many of these children. Most of the x-rays are negative for pneumonia hence could have been avoided, saving time and health care costs and avoid growing children being exposed to harmful radiation.

Studies conducted so far are inconclusive about the clinical features predicting pneumonia among wheezing children which prompted us to go for this study.

AIM OF THE STUDY

AIM OF THE STUDY

Aim of this study is to investigate the value of symptoms and signs in predicting co-existing pneumonia, in children upto 12 years of age with wheezing. This will help in developing a clinical decision rule, for the use of chest x-ray, and also guide in further management of this patient population.

SUBJECTS AND METHODS

SUBJECTS AND METHODS

1. METHODOLOGY

Study design

Descriptive Study.

Study place

Institute of Child Health and Hospital for Children, Chennai.

Study period

November 30, 2011-November 30, 2012.

Study population

Inclusion criteria:

Children less than or equal to 12 years of age with wheezing on auscultation, presenting to the emergency department, for whom chest x-ray has been ordered.

Exclusion criteria:

1. Parents who did not give consent for the study.

2. Patients were excluded if they had conditions predisposing to pneumonia like cystic fibrosis, foreign body aspiration, smoke inhalation, bronchopulmonary dysplasia, congenital heart disease, sickle cell disease, immunosuppression, malignancy, or structural airway abnormalities like tracheal web, ring or tracheomalacia.

Sample size: **384**

Ethical committee clearance was obtained from the institutional ethical committee.

2. MANOEUVRE:

Cases were selected based on inclusion and exclusion criteria after obtaining written informed consent from parents.

Detailed history was taken from all eligible patients regarding age, sex, presence or absence of fever, duration of fever, presence or absence of cough, difficulty in breathing, chest pain abdominal pain, and prior history of wheezing.

Thorough clinical examination was done for all enrolled patients and presence or absence of signs like retractions, tachypnea, grunt, nasal flare, focally decreased air entry, focal or diffuse crepitations, focal or diffuse wheeze were noted.

Axillary temperature was recorded for 3 minutes using digital thermometer. Oxygen saturation was measured using Nellcor pulsoximeter. Respiratory rate was counted by observing the movements of the child's chest or abdomen for 1 full minute when the child was quiet and not crying. Chest indrawing or retractions were noted by seeing the lower ribs of the child. Chest retractions are present if the lower chest wall moves inward during inspiration.

DEFINITIONS:

FEVER:

Child has fever if the axillary temperature is above 37.5 degree Celsius, [IMNCI GUIDELINES].

COUGH:

Act of coughing is a reflex aimed at removal of mucous and other material from the airways that follows the stimulation of cough or irritant receptors.

DYSPNEA:

Dyspnea is the subjective feeling of not being able to satisfy one's air hunger.

CHEST PAIN:

Chest pain in pneumonia is due to pleuritis or distension of pleura that can occur during the course of pneumonia/ empyema.

WHEEZING:

Wheezing is a musical, low pitched or high pitched sighing or whistling sound heard often during expiration. This sound is due to obstruction of lower airways especially the smaller airways.

TACHYPNEA:[WHO criteria]

Defined as a rate of 60 or more breaths per minute in infants younger than 2 months,

50 breaths or more for infants from 2months to 12 months,

40 breaths per minute or more for children 12 months to 5 years,

30 breaths per minute or more for children 5-12 years old.

GRUNTING:

Grunting is a short low pitched sound heard during expiration. Grunting occurs when the child exhales against a partially closed glottis.

CRACKLES:

Crackles also called as rales, are sharp, crackling sounds heard often during inspiration. In early pneumonia crackles are heard in mid inspiration and in recovery phase crackles are heard during end expiration.

NASAL FLARING:

Nasal Flaring refers to the enlargement of the nostrils with each inspiratory breath.

CHEST RETRACTIONS:

Chest indrawing is the inward movement of the soft tissues of the chest wall or sternum during inspiration. Chest retractions are a sign that the child is trying to move the air into the lungs by the increased use of chest wall muscles.

DIAGNOSTIC DEFINITIONS:

X-rays were read by pediatric radiologists in our Institute. X-rays were read as positive or negative for pneumonia. X-rays were read as positive for pneumonia, if it was having single or multiple infiltrates, opacities or consolidation, or consolidation with effusion.

STATISTICAL ANALYSIS:

Comparison of signs and symptoms in patients with and without pneumonia was done using chi-square test for categorical variable and student's test for continuous variables. p value less than 0.05 was considered as significant

Statistically significant variables in the univariate analysis were taken up for multivariate logistic regression analysis.

Sensitivity, specificity and likely hood ratio of variables associated with pneumonia was calculated.

ROC Curve was constructed for the clinical predictors significant at the end of step by step logistic regression analysis.

RESULTS

OBSERVATIONS:

A total of **384** children with wheeze were studied in the age group of 0-12 years.

Demographic characteristics in the study population

Total no. of males = 248(64.6%)

Total no. of females=136(35.4%)

Table-4: Age and sex distribution in the study population

Age in Years	Male n (%)	Female n (%)	Total n (%)
0-1	107(27.9%)	61(15.9%)	168(43.8%)
1-5	123(32.0)	71(18.5%)	194(50.5%)
5-12	18(4.7%)	4(1.0%)	22(5.7%)
Total	**248(64.6%)**	**136(35.4%)**	**384(100%)**

Study population comprised of 248(64.6%) males and 136(35.4%) females. Majority of them are in the age group of 1-5 years 194 (50.5%).Subjects were more likely to be male in all the three age groups.

Chart-1:

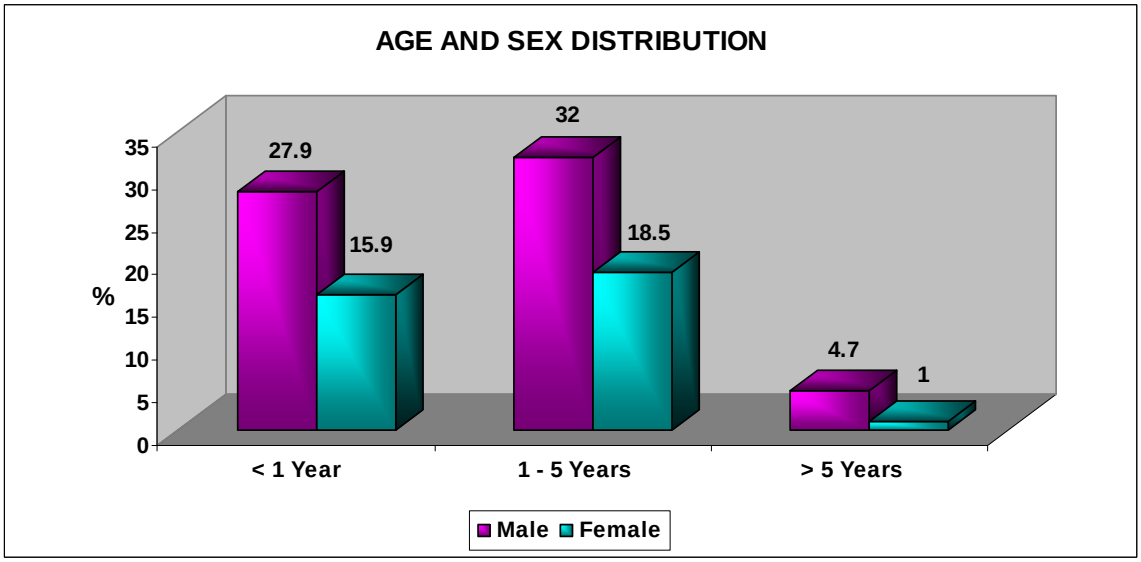


Table 5: Distribution of symptoms and signs among study population:

Symptoms	n (%)
Fever	317(82.6%)
Duration of fever ≤3days >3days	 210(54.7%) 112(29.2%)
Cough	351(91.4%)
Difficulty in breathing	376(97.9%)
First time wheeze	230(59.9%)

History of fever and cough was present in 82.6% and 91.4% of patients respectively. History of fever was absent in 67(17.4%) patients.154 (40.1%) patients had a prior history of wheeze. History of chest or abdominal pain was not present in any of the study subjects.

Table 6: Distribution of symptoms and signs among study population:

Examination Findings	n (%)
Tachypnea	322(83.9%)
Retractions	315(82%)
Grunt	8(2.1%)
Nasal Flare	9(2.3%)
Focally decreased air entry	22(5.7%)
Diffuse Crepitations	239(62.2%)
Focal Crepitations	24(6.3%)
Focal Wheeze	1(0.3%)
Maximum temperature in degree Celsius ≥38.0 ≥38.5 ≥39.0	 171(44.5%) 46(12.0%) 40(10.4%)
Oxygen saturation ≤ 96%	29(7.6%)

Tachypnea, retractions, grunting, nasal flare were present in 83.9%, 82%, 2.1%and 2.3% respectively.Focal findings like focally decreased air entry, focal crepitations, focal wheeze were present in 5.7%, 6.3%, 0.3% of patients respectively. Diffuse crepitations were present in 62.2% of study subjects.Maximum temperature of ≥ 39 degree Celsius and Oxygen saturation of ≤ 96% were present in 10.4% and 7.6% of patients respectively.

Table-7: Age wise distribution of symptoms and signs among study population:

History	**0-1 years n (%)**	**1-5 years n (%)**	**5-12 years n (%)**
Fever	142(84.5%)	158(81.4%)	17(77.3%)
Duration of fever ≤3 days >3days	 95(56.5%) 47(28.0%)	 108(55.7%) 55(28.4%)	 7(31.8%) 10(45.5%)
Cough	161(95.8%)	168(86.6%)	22(100%)
Difficulty in breathing	168(100%)	186(95.9%)	22(100%)
First time wheeze	139(82.7%)	88(45.4%)	3(13.6%)

In the age group of 0-1 year, history of fever, cough, difficulty in breathing, and previous history of wheezing were present in 84.5%, 95.8%, 100%, and 17.3% of patients respectively.

In the age group of 1-5 years, fever, cough, difficulty in breathing and previous history of wheezing were present in 81.4%, 86.6%, 95.9%, and 54.6% of patients respectively.

In the age group of 5-12 years, history of fever, cough, difficulty in breathing, and previous history of wheezing were present in 77.3%, 100%, 100%, and 86.4%.of patients respectively.

Chart-2:

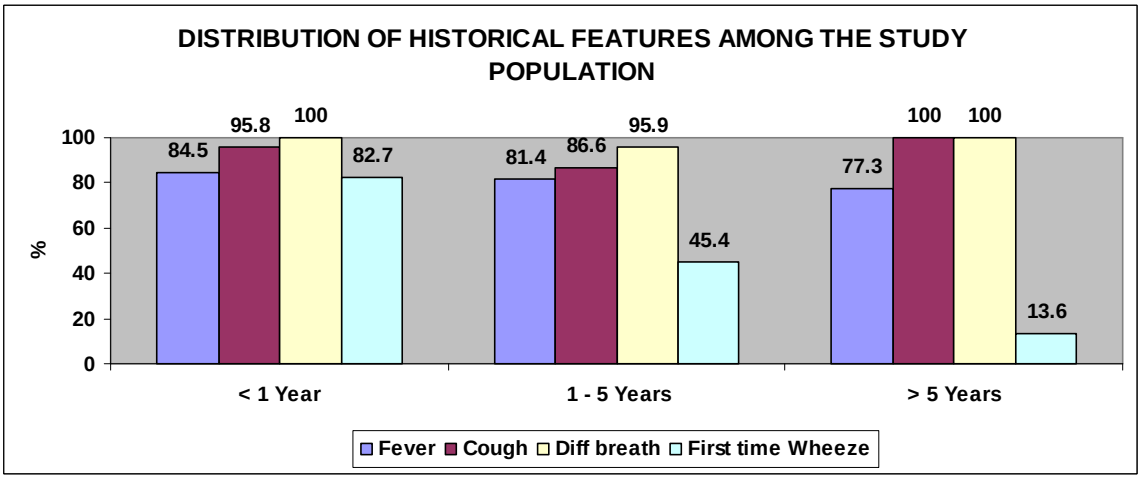


Table-8: Age wise distribution of symptoms and signs among study population:

Examination findings	**0-1 years**	**1-5 years**	**5-12 years**
Tachypnea	132(78.6%)	170(87.6%)	20(90.9)
Retractions	148(88.1%)	151(77.8%)	16(72.7%)
Grunting	4(2.4%)	4(2.1%)	Absent (0%)
Nasal Flare	4(2.4%)	4(2.1%)	Absent (0%)
Focally decreased air entry	10(6%)	7(3.6%)	5(22.7%)
Diffuse Creptitations	102(60.7%)	133(68.6%)	4(18.2)
Focal Crepitations	10(6%)	8(4.1%)	6(27.3%)
Focal wheeze	1(0.6%)	Absent (0%)	Absent (0%)
Maximum Temperature in degree Celsius			
≥38.0	55(32.7%)	101(52.1%)	15(68.2%)
≥38.5	23(13.7%)	17(8.8%)	6(27.3%)
≥39	19(11.3%)	16(8.2%)	5(22.7%)
Oxygen saturation ≤ 96%	16(9.5%)	7(3.6%)	6(27.3%)

In the age group of 0-1 years, tachypnea, retractions, grunt, nasal flare were present in 78.6%, 88.1%, 2.4%, and 2.4% of patients respectively. Diffuse crepitations were present in 60.7% of patients. Focal findings like focally decreased air entry, focal crepitations, focal wheeze were present in 6%, 6% and 0.6% of patients respectively. Maximum temperature of ≥ 39 degree Celsius and oxygen saturation ≤ 96% were present in 11.3% and 9.5% respectively.

In the age group of 1-5 years, tachypnea, retractions, grunt, nasal flare were present in 87.6%, 77.8%, 2.1%, and 2.1% of patients respectively. Diffuse crepitations were present in 68.6% of patients. Focal findings like focally decreased air entry, focal crepitations, focal wheeze were present in 3.6%, 4.1% and 0% of patients respectively. Maximum temperature of ≥ 39 degree Celsius and oxygen saturation ≤ 96% were present in 8.2% and 3.6% of patients respectively.

In the age group of 5-12 years, tachypnea, retractions, grunt, nasal flare were present in 90.9%, 72.7%, 0%,0% respectively .Diffuse crepitations was present in 18.2% of patients . Focal findings like focally decreased air entry, focal crepitations, focal wheeze were present in 22.7%, 27.3%, 0% respectively. Maximum temperature of ≥ 39 degree Celsius and oxygen saturation ≤ 96% were present in 22.7% and 27.3% of patients respectively.

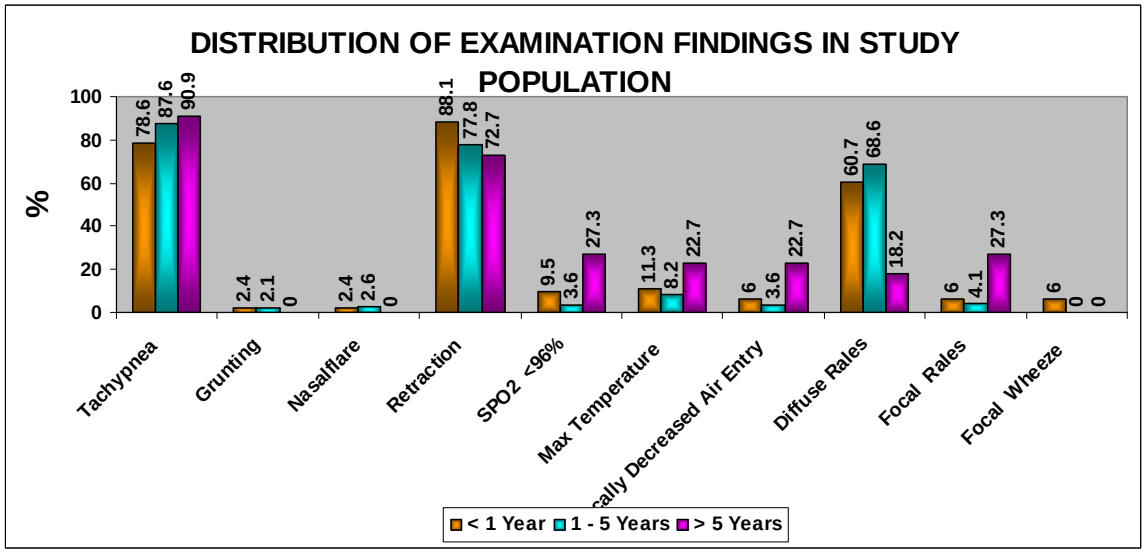


Table-9: Comparison of clinical features in patients with and without pneumonia

History	**Pneumonia(n=47)**	**No Pneumonia (n=337)**	**p value**
Age			
0-1	23(6%)	145(37.8%)	0.038
1-5	18(4.7%)	176(45.8%)	0.060
5-12	6(1.6%)	16(4.2%)	0.819
Sex			
Male	29(7.6%)	219(57%)	0.745
Female	18(4.7%)	118(30.7%)	
Fever	47 (12.2%)	270 (70.3%)	<0.001
Duration of fever			
≤3 days	18(4.7%)	192(50%)	< 0.001
>3days	29(7.6%)	83(21.6%)	
Cough	45(11.7%)	306(79.7%)	0.403
Difficulty in breathing	47(12.2%)	329(85.7%)	0.603
First time wheeze	35(9.1%)	195(50.8%)	0.038

Table-10: Comparison of clinical features in patients with and without pneumonia

Examination	**Pneumonia (n=47)**	**No Pneumonia (n=337)**	**p value**
Tachypnea	40(10.4%)	282(73.4%)	1.000
Retractions	46(12%)	269(70.1%)	0.001
Grunting	8(2.1%)	0(0%)	<0.001
Nasal Flare	9(2.3%)	0(0%)	<0.001
Focally decreased air entry	20(5.2%)	2(5%)	<0.001
Diffuse Creptitations	18(4.7%)	221(57.6%)	0.001
Focal Crepitations	21(5.5%)	3(0.8%)	<0.001
Focal wheeze	0(0%)	1(0.3%)	1.000
Maximum Temperature in degree Celsius ≥38.0 ≥38.5 ≥39	 46(12%) 42(10.9%) 37(9.6%)	 125(32.6%) 4(1%) 3(0.8%)	 <0.001 <0.001 <0.001
Oxygen saturation ≤96%	27(57.4%)	2(0.6%)	<0.001

Radiographic pneumonia was present in 47 patients (12.2%) out of 384 patients in the study population. On Comparing the clinical features of patients with and without pneumonia in the age group of 0-12 years, age <1 year(p=0.038)history of fever(p=<0.001), duration of fever >3 days(p=<0.001), first time wheezing(p value=0.038), presence of retractions(p value 0.001), grunt(p=<0.001), nasal flare(p=<0.001), focally decreased air entry(p=<0.001), diffuse (p=0.001)as well as focal crepitations(p=<0.001), maximum temperature more than 38 degree Celsius(p=<0.001), oxygen saturation ≤ 96% (p=<0.001)were found to be statistically significant in predicting radiographic pneumonia in the study subjects.

There was no sex predilection to developing pneumonia in any of the three age groups. Tachypnea which is predictive of pneumonia in many other studies is not a predictor of pneumonia in any of the age groups in this study.

Table 11: Sensitivity, specificity and likely hood ratio of variables

Variables	**Sensitivity**	**Specificity**	**Likelihood Ratio**
Fever	1(0.90-1)	0.19(0.16-0.25)	1.25(1.18-1.32)
First time wheeze	0.74(0.59-0.85)	0.42(0.37-0.48)	1.29(1.06-1.55)
Retractions	0.98(0.87-0.99)	0.20(0.16-0.25)	1.23(1.14-1.31)
Focally Decreased Air entry	0.42(0.29-0.578)	0.99(0.98-0.99)	71.70(17.31-296.99)
Diffuse Crepitations	0.38(0.25-0.54)	0.34(0.29-0.39)	0.58(0.40-0.84)

Focal Crepitations	0.45(0.30-0.59)	0.99(0.97-0.99)	50.19(15.57-161.81)
Maximum Temperature in degrees			
≥38.0	0.98(0.87-0.99)	0.63(0.57-0.68)	2.64(2.28-3.05)
≥38.5	0.89(0.76-0.96)	0.99(0.97-0.99)	75.29(28.28-200.42)
≥39.0	0.79(0.64-0.89)	0.99(0.97-0.99)	88.43(28.38-275.49)
Oxygen Saturation ≤ 96 Percentage	0.57(0.42-0.71)	0.99(0.98-0.99)	96.79(23.79-393.92)

Focally decreased air entry, focal crepitations, maximum temperature ≥38.5 degree Celsius, oxygen saturation ≤96% are the most specific predictors of radiographic pneumonia. Those with temperature ≥38 degree Celsius are 2.64(2.28-3.05) times more likely to have pneumonia. Increase in the temperature increases the likelihood ratio of having pneumonia in chest X-ray. Patients with oxygen saturation ≤96 % were 96.7 times more likely to have pneumonia in this study.

Among the total study population, which includes children with wheezing from 0-12 years, history of fever is highly sensitive (100%) in predicting pneumonia. Next to fever, presence of retractions and temperature ≥38 degree Celsius has a higher sensitivity of 98% but low specificity of 20% and 63% respectively. Presence of grunting and nasal flare has the highest specificity of 100% but has the lowest sensitivity of 17% and 19% respectively.

Table 12: Comparison of clinical features in children aged 0-1 year with and without pneumonia.

History	**Pneumonia (n=23)**	**No Pneumonia (n=145)**	**p value**
Sex Male Female	 13(7.7%) 10(6%)	 94(56%) 51(30.4%)	 0.488
Fever	23(13.7%)	119(70.8%)	0.027
Duration of fever ≤3 days >3days	 11(6.5%) 12(7.1%)	 84(50%) 35(20.8%)	 0.002
Cough	22(13.1%)	139(82.7%)	1.000
Difficulty in breathing	23(13.7%)	145(86.3%)	*
First time wheeze	21(12.5%)	118(70.2%)	0.374

* - Present in all subjects in 0-1 year of age. Hence p value cannot be calculated

Table 13: Comparison of clinical features in children aged 0-1 year with and without pneumonia.

Examination	**Pneumonia (n=23)**	**No Pneumonia (n=145)**	**p value**
Tachypnea	17(10.1%)	115(68.5%)	0.587
Retractions	23(13.7%)	125(74.4%)	0.079
Grunting	4(2.4%)	0(0%)	<0.001
Nasal Flare	4(2.4%)	0(0%)	<0.001
Focally decreased air entry	9(5.4%)	1(6%)	<0.001
Diffuse Creptitations	12(7.1%)	90(53.6%)	0.370
Focal Crepitations	7(4.2%)	3(1.8%)	<0.001
Focal wheeze	0(0%)	1(6%)	1.000
Maximum Temperature in degree Celsius ≥38.0 ≥38.5 ≥39	 23(13.7%) 22(13.1%) 18(10.7%)	 32(19%) 1(0.6%) 1(0.6%)	 <0.001 <0.001 <0.001
Oxygen saturation ≤ 96%	16(9.5%)	0(0%)	<0.001

In the age group of 0-1 year, history of fever and duration of fever > 3 days, focally decreased air entry, focal crepitations, grunt, nasal flare temperature more than 38 degree Celsius and oxygen saturation ≤ 96% were found to be statistically significant as in the total study population. But first time wheeze (p=0.374), presence of retractions (0.079) and diffuse crepitations (p=0.370) which were significant (p<0.05) in total study population were not predictive of pneumonia in this age group.

Table 14: Comparison of Clinical features in Children aged 1-5 years with and without pneumonia

History	**Pneumonia (n=18)**	**No Pneumonia (n=176)**	**p value**
Sex Male Female	 10(5.2%) 8(4.1%)	 113(58.2%) 63(32.5%)	 0.456
Fever	18(9.3%)	140(72.2%)	0.028
Duration of fever ≤3 days >3days	 6(3.1%) 12(6.2%)	 102(52.6%) 43(22.2%)	 <0.001
Cough	17(8.8%)	151(77.8%)	0.476
Difficulty in breathing	18(9.3%)	168(86.6%)	1.000
First time wheeze	13(6.7%)	75(38.7%)	0.024

Table 15: Comparison of Clinical features in Children aged 1-5 years with and without pneumonia

Examination	**Pneumonia (n=18)**	**No Pneumonia (n=176)**	**p value**
Tachypnea	17(8.8%)	153(78.9%)	0.705
Retractions	17(8.8%)	134(69.1%)	0.131
Grunting	4(2.1%)	0(0%)	<0.001
Nasal Flare	5(2.6%)	0(0%)	<0.001
Focally decreased air entry	6(3.1%)	1(0.5%)	<0.001
Diffuse Creptitations	6(3.1%)	127(655.5%)	0.002
Focal Crepitations	8(4.1%)	0(0%)	<0.001
Focal wheeze	0(0%)	0(0%)	-
Maximum Temperature in degree Celsius ≥38.0 ≥38.5 ≥39	 17(8.8%) 14(7.2%) 14(7.2%)	 84(43.3%) 3(1.5%) 2(1%)	 <0.001 <0.001 <0.001
Oxygen saturation ≤ 96%	6(3.1%)	1(0.5%)	<0.001

Clinical features of patients with and without pneumonia in this age group (1-5 years) did not differ from the total study population (which includes all the three age groups). The variables which were predicting pneumonia in all the age groups combined were statistically significant in this age group too.

Table16: Comparison of clinical features of patients with and without pneumonia in the age group of 5-12 years

History	**Pneumonia (n=6)**	**No Pneumonia (n=16)**	**p value**
Sex Male Female	 6(27.3%) 0(0%)	 12(54.5%) 4(18.2%)	 0.541
Fever	6(27.3%)	11(50%)	0.266
Duration of fever ≤3 days >3days	 1(4.5%) 5(22.7%)	 6(27.3%) 5(22.7%)	 0.032
Cough	6(27.3%)	16(72.7%)	*
Difficulty in breathing	6(27.3%)	16(72.7%)	*
First time wheeze	0(0%)	0(0%)	*

- features present or absent in all subjects. Significance cannot be calculated

Table 17: Comparison of clinical features of patients with and without pneumonia in the age group of 5-12 years

Examination	**Pneumonia (n=6)**	**No Pneumonia (n=16)**	**p value**
Tachypnea	6(27.3%)	14(63.6%)	1.000
Retractions	6(27.3%)	10(45.5%)	0.133
Grunting	6(27.3%)	16(72.7%)	<0.001
Nasal Flare	6(27.3%)	16(72.7%)	<0.001
Focally decreased air entry	1(4.5%)	16(72.7%)	<0.001
Diffuse Creptitations	0(0%)	4(18.2%)	0.541
Focal Crepitations	6(27.3%)	0(0%)	<0.001
Focal wheeze	0(0%)	0(0%)	*
Maximum Temperature in degree Celsius			
≥38.0	6(27.3%)	9(40.9%)	0.121
≥38.5	6(27.3%)	0(0%)	<0.001
≥39	5(22.7%)	0(0%)	<0.001
Oxygen saturation ≤96%	5(22.7%)	1(4.5%)	0.001

*Focal wheeze –absent in children 5-12 years.

There were 22 subjects in the age group of 5-12 years. Duration of fever more than 3 days (p=0.032), presence of grunt (p=<0.001), nasal flare (p=<0.001), focally decreased air entry (p=<0.001), focal crepts (p=<0.001), maximum temperature ≥38.5 (p=<0.001), oxygen saturation ≤ 96 %(p=0.001) were the variables associated with the presence of pneumonia in this age group.

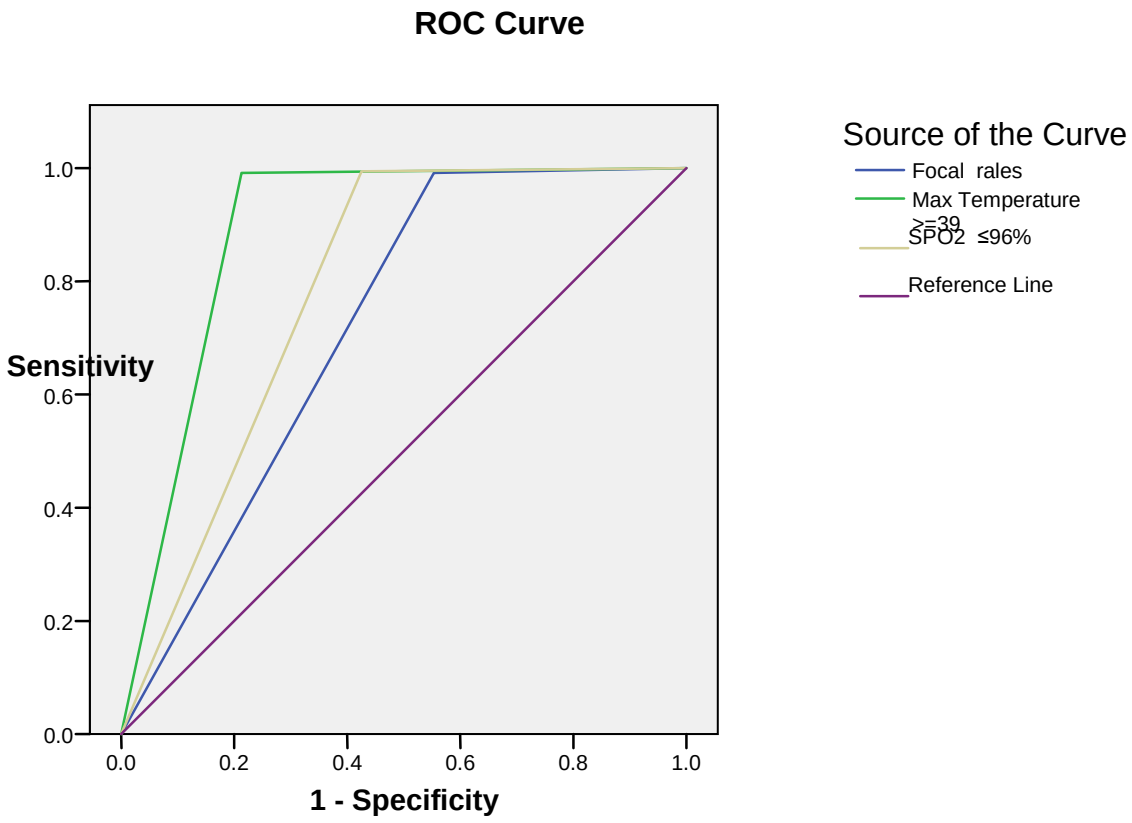
Since history of cough, difficulty in breathing was present in all patients in this age group, test for significance could not be done for these two variables.

Variables which were statistically significant (p<0.05) in all the three age groups were taken up for the step by step logistic regression analysis.

FINAL TABLE IN THE STEP BY STEP LOGISTIC REGRESSION ANALYSIS

Variables	B	S.E.	Wald	df	Sig	EXP(B)	95% CI for EXP(B)	
							Lower	Upper
Age <=1	-0.053	0.663	0.006	1	0.936	0.948	0.259	3.475
Retractions	1.432	1.279	1.254	1	0.263	4.188	0.342	51.369
FD Air Entry	1.289	2.218	0.338	1	0.561	3.630	0.047	280.716
Focal Rales	4.685	1.186	15.604	1	0.000	108.300	10.595	1107.044
Diffuse Rales	0.256	0.883	0.084	1	0.772	1.292	0.229	7.294
First Time Wheeze	-0.775	0.786	0.973	1	0.324	0.460	0.099	2.149
SPO2 ≤96%	3.572	1.245	8.231	1	0.004	35.604	3.102	408.709
Max Temperature >=39	5.371	0.908	34.975	1	0.000	215.066	36.268	1275.325
Constant	-74.658	24981.701	0.000	1	0.998	0.000		

At the end of step by step logistic regression analysis, three parameters maximum temperature ≥39 degree Celsius (<0.001), focal crepitations (<0.001) and oxygen saturation ≤96 %(0.004) were found be significant.



Diagonal segments are produced by ties.

ROC curve is the measure of accuracy of the diagnostic test. Here maximum temperature ≥ 39 degree Celsius occupies more area (AUC=0.889) hence more accurate in predicting pneumonia than oxygen saturation ≤ 96% (AUC=0.784) and focal crepitations (AUC=0.719).

DISCUSSION

DISCUSSION

This is a descriptive study conducted in children 0-12 years of age with wheeze on examination.

Children in the age group of 0-1 year of age have an increased risk of developing pneumonia (p=0.038) in this study, which differs from the study conducted by Bony Mathews (9) where there was no age predilection to develop pneumonia. Since our institute is a tertiary referral centre further multi center studies are needed to confirm this.

There was a male preponderance (64.6%) in this study. However there was no sex predilection to developing pneumonia in our study which is consistent with other studies.

In this study, radiographic pneumonia was present in 47 (12.2%) out of the 384 patients in the study population. Similar study conducted by Bony Mathews (9) showed a prevalence of 4.9% in children with wheeze. Slightly higher prevalence in our population may be because this study was conducted in a tertiary referral centre one of the largest in South India.

The strongest predictors of pneumonia after step by step logistic regression analyses in our study were temperature ≥39 degree Celsius, oxygen saturation ≤96% and focal crepitations.Among the three,

temperature ≥ 39 degree Celsius occupies maximum area in the ROC cureve and hence has the greatest accuracy of predicting pneumonia in our study, which is similar to many other studies conducted so far.

In a study conducted by Bony Mathews(9), history of fever was predictive of pneumonia in all age groups. But in our study, history of fever was predictive of pneumonia in children less than 5 years only. This may be due to less number of children present in the age group of 5-12 years in our study. However duration of fever > 3 days was associated with pneumonia in all the three age groups in our study.

Duration of fever more than 3 days, grunt, nasal flare, focally decreased air entry, focal crepitations, maximum temperature ≥38.5, oxygen saturation ≤ 96% were associated with increased risk of developing pneumonia in all age groups in this study.

History of Cough, difficulty in breathing and tachypnea were not associated with pneumonia in our study. Our study differs from the study conducted by Melinda Mahabee Gittens (11) in which tachypnea was a significant predictor of pneumonia. However our study cannot be compared with many other studies as they all differ in study design, inclusion criteria, age group selected etc.

Presence of history of fever has the highest sensitivity in predicting pneumonia in this study however it has a low specificity. None of the clinical predictors in our study have both high sensitivity as well as specificity in predicting pneumonia.

In a study done by Lynch et al, history of fever, tachypnea, increased heart rate, crepitations retractions, grunting, decreased breath sounds were associated with radiographic pneumonia. Our study results are also consistent with that study except that tachypnea is not a predictor of pneumonia in our study and diffuse crepitations were associated with increased risk of pneumonia in the age group of 1-5 years only.

Focal wheeze was present in only one patient 6% in our study. History of first time wheeze was associated with increased likely hood of pneumonia in the age group of 1-5 years only.

Though many studies have been done so far to predict pneumonia in children only few studies have been done in children with wheezing. One such study was done by Bony Mathews between November 2006-07. Our study differs from the study done by Bony Mathews in that decreased breath sounds, focal rales and diffuse crepitations are associated with pneumonia in our study.

Hypoxia (sp02<92%) was associated with radiological pneumonia only in children less than 2 years of age in their study. But in our study hypoxia (spo2< 96%) is associated with increased risk of pneumonia in all age groups (0-12 years).

Many studies conducted so far among children with wheezing were done in children below two years of age. Patients with prior history of wheezing or asthma were excluded from the study. Hence the results cannot be generalized to general population.

Our study includes children upto 12 years of age and also those with previous history of wheeze/ asthma. This makes our study more generalizable.

By constructing ROC curve we found that maximum temperature ≥39 degree Celsius which occupies maximum area under the curve (0.889) is the strongest predictor of pneumonia in our study.

LIMITATIONS

LIMITATIONS OF THE STUDY

1. The study was conducted in a tertiary care institute. Hence the study population differs from the general population.

2. Less number of children was present in the age group of 5-12 years.

3. Children who presented with wheeze but for whom chest x-ray was not taken were excluded. This limits the generalizability of the results.

CONCLUSION

CONCLUSION

- Children with wheeze can be stratified into two groups, high or low risk based on our history and clinical examination.

- Presence of fever is a highly sensitive predictor of pneumonia. Patients with temperature ≥39 degree Celsius, focal crepitations, oxygen saturation ≤ 96% are more likely to have radiographic pneumonia.

- Patients without these findings are at low risk of having radiographic pneumonia.

RECOMMENDATIONS

RECOMMENDATIONS

- Children with wheeze should be triaged based on the clinical predictors into low and high risk groups.

- Chest x-rays should be avoided in low risk groups. This prevents children from exposure to harmful radiation and helps to reduce the health care cost.

- Further multicenter studies are needed with adequate sample size to refine our clinical prediction rules.

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ANNEXURES

ABBREVIATIONS

ABBREVIATIONS

AIDS –Acquired Immuno Deficiency Syndrome

AUC-Area under Curve

B/L-Bilateral

CRP-C-Reactive Protein

ESR-Erythrocyte Sedimentation Rate

GERD-Gastro Esophageal Reflux Disease

IAP-Indian Academy of Pediatrics

IMNCI-Integrated Management of Neonatal and Childhood Illness

IV-Intravenous

MRSA-Methicillin Resistant Staphylococcus Aureus

PCR-Polymerase Chain Reaction

ROC- Receiver Operating Characteristic

WHO- World Health Organization

WBC-White Blood Corpuscles

DATA COLLECTION FORM

NAME: AGE: SEX:

DATE OF INCLUSION:

ADDRESS:

TELEPHONE NO:

HISTORY:

SNO	**Symptoms**	
1.	Fever	
2.	Duration of fever	
3.	Cough	
4.	Dyspnea	
5.	First time wheeze	
6.	Abdominal pain	
7.	Chest pain	

EXAMINATION:

S.NO	**Signs**	
1.	Tachypnea	
2.	Retractions	
3.	Grunt	
4.	Nasal flare	
5.	Maximum temperature	
6.	Lowest SpO2	
7.	Focally decreased air entry	
8.	Focal Crepitations	
9.	Diffuse crepitations	
10.	Focal Wheeze	

Chest x-ray report:

INSTITUTIONAL ETHICS COMMITTEE
MADRAS MEDICAL COLLEGE, CHENNAI -3

Telephone No : 044 25305301
Fax : 044 25363970

CERTIFICATE OF APPROVAL

To
Dr. M. Sarasu
PG in MD Paediatrics
Madras Medical College, Chennai -3

Dear Dr. M. Sarasu

The Institutional Ethics committee of Madras Medical College, reviewed and discussed your application for approval of the proposal entitled "Clinical predictors of pneumonia among children upto 12 years of age with wheezing" No.07062012.

The following members of Ethics Committee were present in the meeting held on 19.06.2012 conducted at Madras Medical College, Chennai -3.

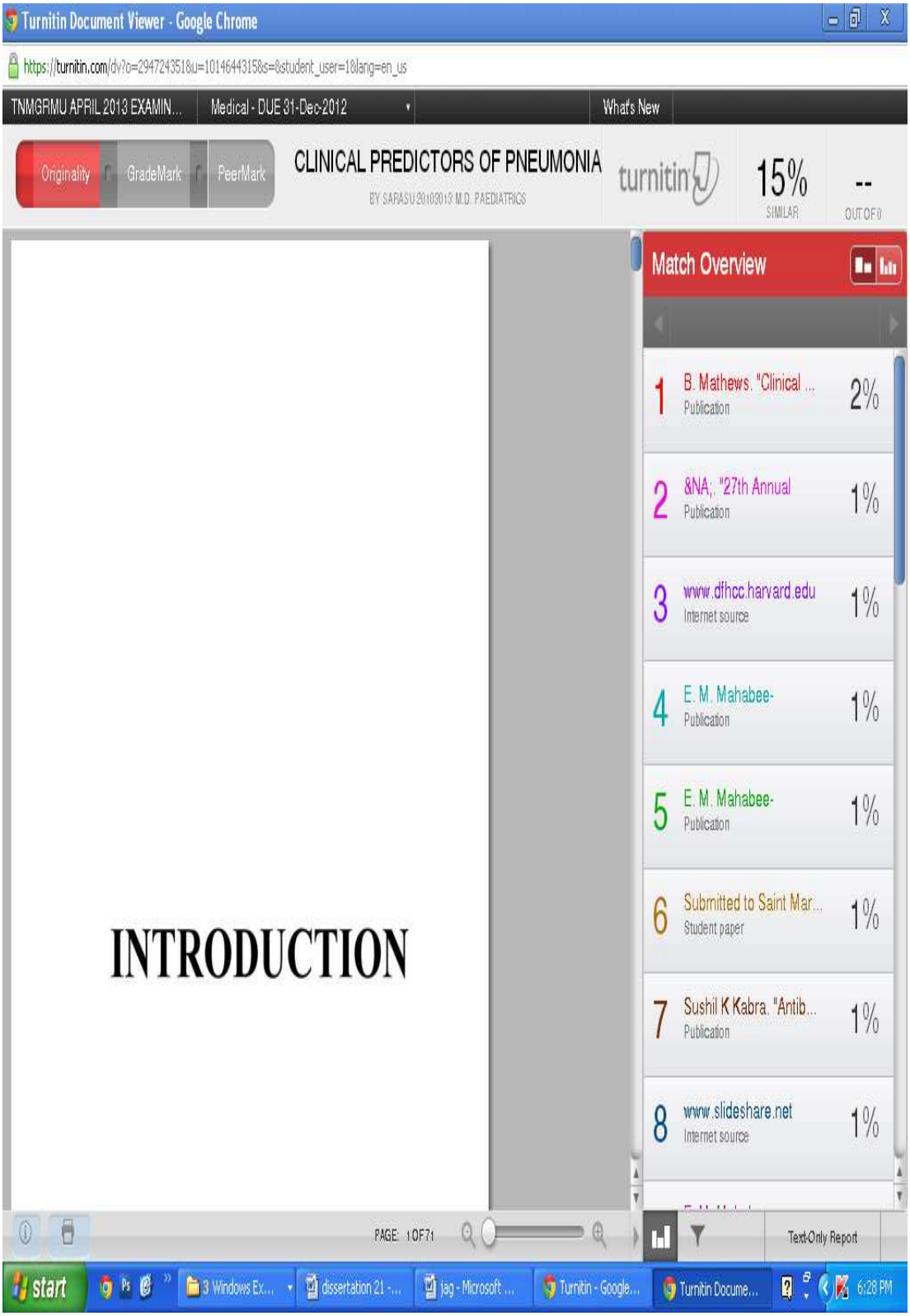
1.	Dr. S.K. Rajan. M.D.,FRCP.,DSc	-- Chairperson
2.	Prof. K. Ramadevi MD Prof of Biochemistry, MMC, Ch-3	-- Member
3.	Prof. R. Nandhini MD Director, Inst. of Pharmacology ,MMC, Ch-3	-- Member
4.	Prof. C. Rajendiran, MD Director , Inst. of Internal Medicine, MMC, Ch-3	-- Member
5.	Prof. S. Deivanayagam MS Prof of Surgery, MMC, Ch-3	-- Member
6.	Prof. A. Radhakrishnan MD Prof of Internal Medicine, MMC, Ch-3	-- Member

We approve the proposal to be conducted in its presented form.

Sd/ Chairman & Other Members

The Institutional Ethics Committee expects to be informed about the progress of the study, and SAE occurring in the course of the study, any changes in the protocol and patients information / informed consent and asks to be provided a copy of the final report.

Member Secretary, Ethics Committee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